

# ***CO<sub>2</sub>/pH Controller***

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## ***User's Manual***

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*CO<sub>2</sub> Gas/pH Controller MA1 70-2116*



**HARVARD**  

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**A P P A R A T U S**

# WEEE/RoHS Compliance Statement

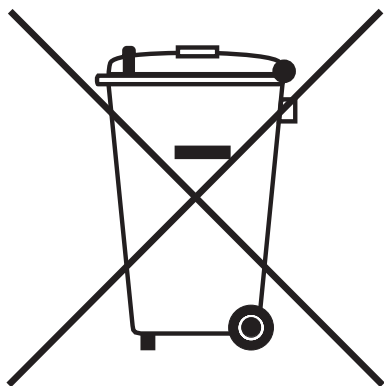
## EU Directives WEEE and RoHS

To Our Valued Customers:

We are committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for our products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive - Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of our products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. We will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.



- **Do Not Dispose Product with Municipal Waste**
  - **Special Collection/Disposal Required**

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# Warranty and Repair Information

## Serial Numbers

All inquiries concerning our product should refer to the serial number of the unit. Serial numbers are located on the rear of the chassis.

## Calibrations

All electrical apparatus is calibrated at rated voltage and frequency.

## Warranty

Harvard Apparatus warrants this instrument for a period of one year from date of purchase. At its option, Harvard Apparatus will repair or replace the unit if it is found to be defective as to workmanship or material.

This warranty does not extend to damage resulting from misuse, neglect or abuse, normal wear and tear, or accident.

This warranty extends only to the original customer purchaser.

**IN NO EVENT SHALL HARVARD APPARATUS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Some states do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE.** Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the two-year warranty period, promptly contact ***Harvard Apparatus, 84 October Hill Road, Building 7, Holliston, Massachusetts 01746-1371*** using our toll free number 1-800-272-2775. Goods will not be accepted for return unless an RMA (returned materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs, replacement and return. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.

## Repair Facilities and Parts

Harvard Apparatus stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using our part numbers. If practical, enclose a sample or drawing. We offer a complete reconditioning service.

## CAUTION

This pH controller is not registered with the FDA and is not for clinical use on human patients.



**CAUTION: Not for clinical use on human patients.**

# Specifications

## Specifications

<b>Range</b>	0 to 14 pH
<b>Resolution</b>	0.01 pH
<b>Accuracy</b>	±0.02 pH
<b>Input Resistance</b>	10 <sup>12</sup> Ω
<b>Calibration:</b>	
<b>Offset</b>	±2 pH through offset trimmer
<b>Slope</b>	80 to 110% through slope trimmer
<b>CO<sub>2</sub> Flowmeter</b>	2 L per min.
<b>Gas Input/Output Connectors</b>	Quick disconnect fittings
<b>pH Analog Output</b>	BNC connector 4-20 mA
<b>Electrode Response Time</b>	~0 sec
<b>Electrode Slope</b>	55 mV/pH in pH range of 1 to 14
<b>Electrode Impedance</b>	200 MΩ
<b>Electrode Stability</b>	0.05 pH/day
<b>Electrode Dimensions, L x D</b>	1.5 x 0.03 in (38.1 x 0.75 mm)
<b>System Power</b>	12 VDC (Universal 90/240 VAC, 50/60 Hz adapter)
<b>Dimensions, H x W x D</b>	12.2 x 15.2 x 12.7 cm (4.8 x 6 x 5 in)
<b>Weight</b>	0.8 kg (1.75 lb)

# Unpacking

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Remove the pH controller and its components from the packing material. Inspect the controller unit and components for damage. If any damage is found contact Harvard Apparatus and do not use equipment unless otherwise specified by Harvard Apparatus.

## Your pH Controller System Includes:

- (1) Controller unit
- (1) Micro pH probe (69-0494)
- (1) Twin axial BNC connector for analog out
- (1) Output Hose  $\frac{1}{16}$ " I.D. medical grade tubing
- (1) AC/DC power adapter
- (1) Power Cord

## Required for Use:

Length of  $\frac{1}{8}$ " I.D. tubing to connect CO<sub>2</sub> Gas source and CO<sub>2</sub> Input on rear of the pH controller unit.

## Plumbing

- **CO<sub>2</sub> In-** CO<sub>2</sub> input. This port requires a  $\frac{1}{8}$ " ID flexible tubing. Input pressure source should be regulated to 10psi. Max.
- **CO<sub>2</sub> Gas Output-** This connection requires an output hose with a quick disconnect fitting (supplied with the unit). The output gas should be delivered directly to the cell culture (this is best accomplished by using Harvard's PDMD).

## Electrical

- **12 VDC-** The pH controller requires 12 VDC power. Use only the adapter provided with the pH controller unit.
- **pH Electrode Input-** This is an isolated BNC connector that receives the input signal from the micro pH probe (69-0494).
- **Analog Out-** This twin axial BNC connector carries the data out signal (0 to 20 mA or 4 to 20 mA) for use with data acquisition system or chart recorder.



CO<sub>2</sub>/pH Controller  
Back View



## Turning pH Controller On

Make sure all connections have been properly made to the pH controller unit:

- 12 VDC connection
- CO<sub>2</sub> input hose
- Analog Out cable (to recorder or other)
- pH Electrode
- CO<sub>2</sub> output hose

Depress the “I” side of the switch on the rear of the pH controller unit. When the pH controller is powered the “**Power On**” LED should illuminate.

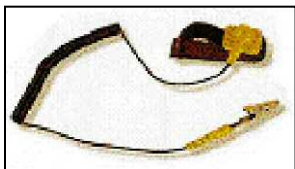
## pH Probe Calibration

The CO<sub>2</sub>/pH Controller has been calibrated with an OFFSET for 7.0pH and a SLOPE for 4.0pH with a set up point of 6.50pH. Refer to the pH meter's user manual (included) for instructions on performing a 2-point or 3-point calibration.

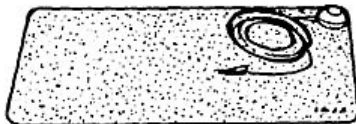
## Required Materials for Calibration

- Three pH buffer solutions with pH of 4.0, 7.0, and 9.21.

The micro pH probe provided is extremely sensitive and should be calibrated daily to ensure accurate readings. Due to the high sensitivity of the probe, electro static discharges can create false spikes in the pH readings. For best results use the probe in a shielded environment and make sure that operator uses an anti-static discharge device when ever possible. Another method to wrap the electrode probe with aluminum foil (shield). If needed the aluminum foil can be grounded.



Anti Static Wrist Strap Kit



Electrostatic Discharge Mats

## pH Set Point Configuration

This CO<sub>2</sub>/pH controller is a unilateral pH controller, which means that it only controls pH in one direction, in this case it can only prevent the pH from becoming too basic. With this controller, a pH set point can be entered; which will tell the pH controller to prevent medium's pH from rising above this set point by dosing and acid (carbon dioxide). To learn how to configure a pH set point, refer to the pH meter's user manual (included).

## Flow Control Configuration

The flow control is located on the front of the pH controller. It determines the flow rate at which the CO<sub>2</sub> is delivered to the medium. Increasing the flow rate will reduce the response time of the pH controller, and increase the pH overshoot of the controller. The overshoot of the pH controller is defined as the amount of pH that the controller will reduce the medium's pH, below that of the configured set point.

There will always be some overshoot that occurs when CO<sub>2</sub> is delivered, because



once the CO<sub>2</sub> flow to the medium is shut off, some CO<sub>2</sub> will still diffuse into the medium, thus further reducing the pH.

The desired flow rate for a particular medium will depend heavily on the buffering capabilities of the medium itself. Mediums with weak basic buffering capabilities will respond quickly to the addition of the acid and will have a larger overshoot. Mediums with strong basic buffering capabilities will respond slower and have a smaller pH overshoot.

There is also a flow control switch, which controls the internal gas flow valve. There are three possible settings for this switch: Manual, Auto, and Momentary.

- **Manual-** (Up) Regardless of the pH set point the flow of CO<sub>2</sub> gas is continuous. The flow rate will be controlled by adjusting the regulator (LED will remain lit).
- **Auto-** (Center) The CO<sub>2</sub>/pH controller will use the set point to activate the on/off flow of CO<sub>2</sub> gas automatically. (LED will lit only when the valve is activated and delivering CO<sub>2</sub>).
- **Momentary-** (Down) CO<sub>2</sub> will flow as long as the switch is depressed. When the switch is released it will return to the automatic mode (the LED will lit as long as the switch is depressed).

## Operation

### Configuration and Setup

1. Make all of the appropriate connections to the CO<sub>2</sub>/pH controller unit. (Power, Hoses and Probe)
2. Calibrate the micro pH probe.
3. Configure the pH set point.
4. Set the flow control.
5. Place the flow control switch in the Auto position.
6. Ensure that CO<sub>2</sub> can be delivered directly to the medium. We recommend using Harvard Apparatus's PDMI to guarantee proper CO<sub>2</sub> distribution over the medium.

Other than the initial configuration and setup, the pH controller needs no additional input to perform. The CO<sub>2</sub>/pH controller will monitor the pH and automatically make adjustments depending on the pH set point.

# Combination pH Electrode for Micro Wells

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The pH electrode requires no external reference and it is designed to fit small perfusion chambers without effecting fluid exchange rate.

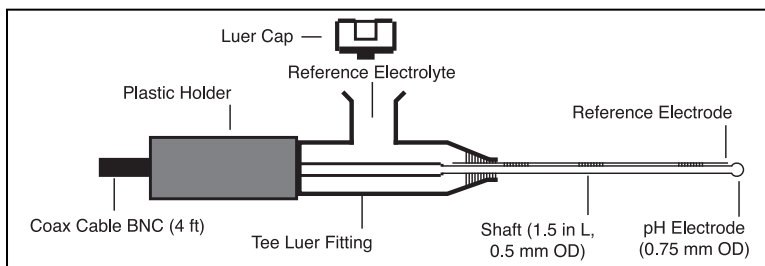
The electrode is pre-filled with reference solution (3M NaCl solution in 25% glycerol). There is no need to refill the reference electrode. If the tip of the reference electrode is blocked, open the luer cap and apply pressure to the luer port. The reference solution will appear at the tip (seen under a 10x magnification lens).

Fill the Tee fitting and put the luer cap back in its place.

## Calibration

1. Connect the pH electrode to the BNC input of the pH meter.
2. Place the electrode tip in a pH 7.00 buffer and set the meter OFFSET to pH 7.00
3. Rinse the electrode tip with distilled water.
4. Place the electrode tip in a pH 4.00 buffer and set the meter SLOPE to pH 4.00
5. Place the electrode tip in the pH 7.00 buffer to confirm the settings.

One can choose the mV mode and plot the pH vs. the corresponding mV values.



This miniature combination pH/reference electrode has been designed to fit small perfusion chambers without effecting fluid exchange rates. It does not require an external reference electrode. The reference solution can be replaced. The electrode is stored wet.

## Specifications

<b>Response Time</b>	~10 sec
<b>Slope</b>	55 mV/pH range of 1 to 14
<b>Impedance</b>	200 M $\Omega$
<b>Stability</b>	0.05 pH/day
<b>Dimensions, L x D</b>	1.5 x 0.03 in (38.1 x 0.75 mm)

## Catalog No.

BS4 69-0494

## Product

Combination pH Electrode for Micro Wells